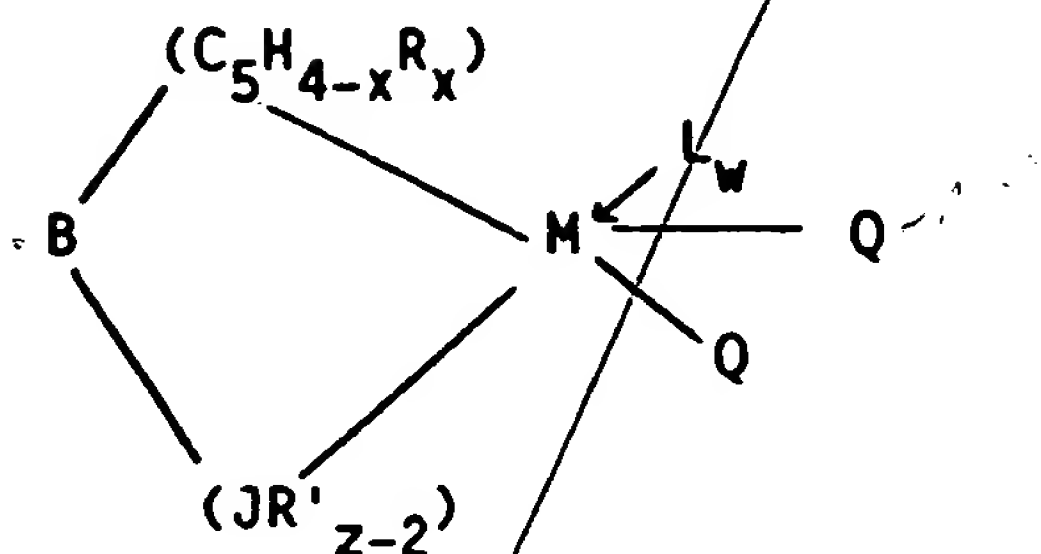
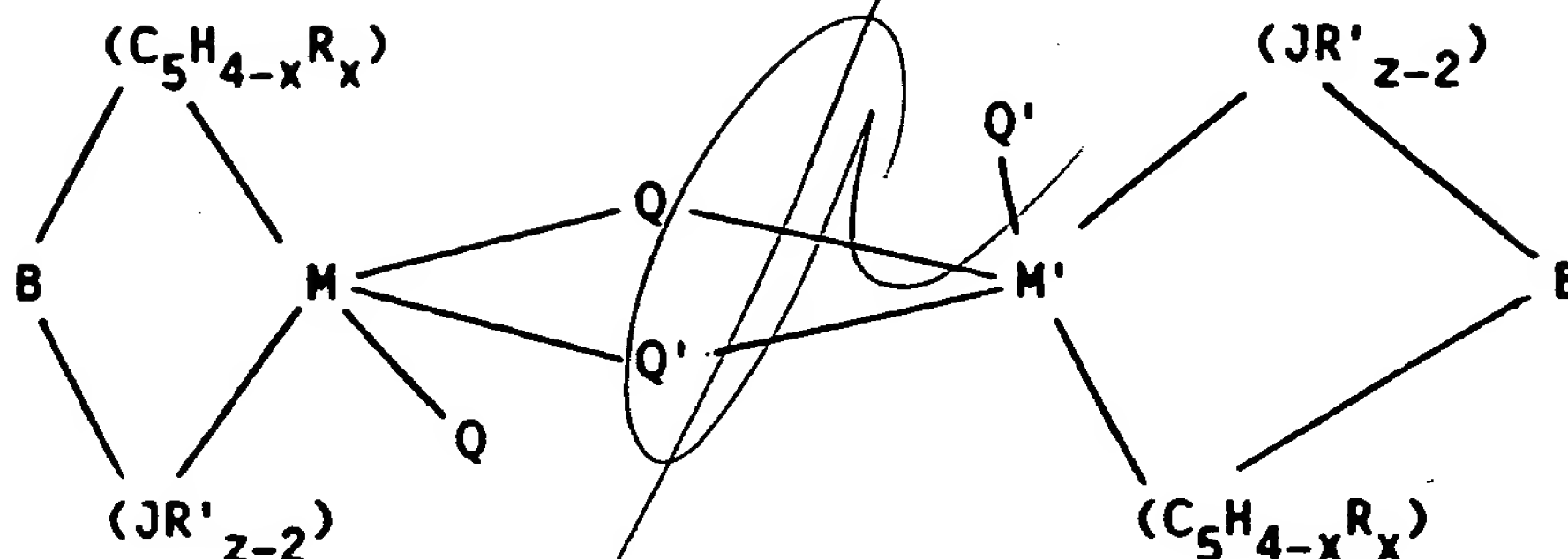


CLAIMS:

1. A compound having the general formula:



or



2 wherein M is Zr, Hf or Ti;

3  $(C_5H_{4-x}R_x)$  is a cyclopentadienyl ring which is  
 4 substituted with from zero to four substituent groups R, "x" is 0, 1,  
 5 2, 3, or 4 denoting the degree of substitution, and each substituent  
 6 group R is, independently, a radical selected from a group consisting  
 7 of  $C_1-C_{20}$  hydrocarbyl radicals, substituted  $C_1-C_{20}$   
 8 hydrocarbyl radicals wherein one or more hydrogen atoms is replaced  
 9 by a halogen atom,  $C_1-C_{20}$  hydrocarbyl-substituted metalloid  
 10 radicals wherein the metalloid is selected from the Group IV A of the  
 11 Periodic Table of Elements, and halogen radicals or  $(C_5H_{4-x}R_x)$   
 12 is a cyclopentadienyl ring in which two adjacent R-groups are joined  
 13 forming  $C_4-C_{20}$  ring to give a saturated or

14 unsaturated polycyclic cyclopentadienyl ligand;

15 (JR'<sub>z-2</sub>) is a heteroatom ligand in which J is an  
16 element with a coordination number of three from Group V A or an  
17 element with a coordination number of two from Group VI A of the  
18 Periodic Table of Elements, and each R' is, independently a radical  
19 selected from a group consisting of C<sub>1</sub>-C<sub>20</sub> hydrocarbyl radicals,  
20 substituted C<sub>1</sub>-C<sub>20</sub> hydrocarbyl radicals wherein one or more  
21 hydrogen atoms is replaced by a halogen atom, and "z" is the  
22 coordination number of the element J;

23 each Q is, independently any univalent anionic ligand  
24 or or two Q's are a divalent anionic chelating ligand;

25 B is a covalent bridging group containing a Group IV A  
26 or V A element; and

27 L is a Lewis base where "w" denotes a number from 0 to  
28 3.

1 2. The compound of claim 1 wherein the heteroatom ligand  
2 group J element is nitrogen, phosphorous, oxygen or sulfur.

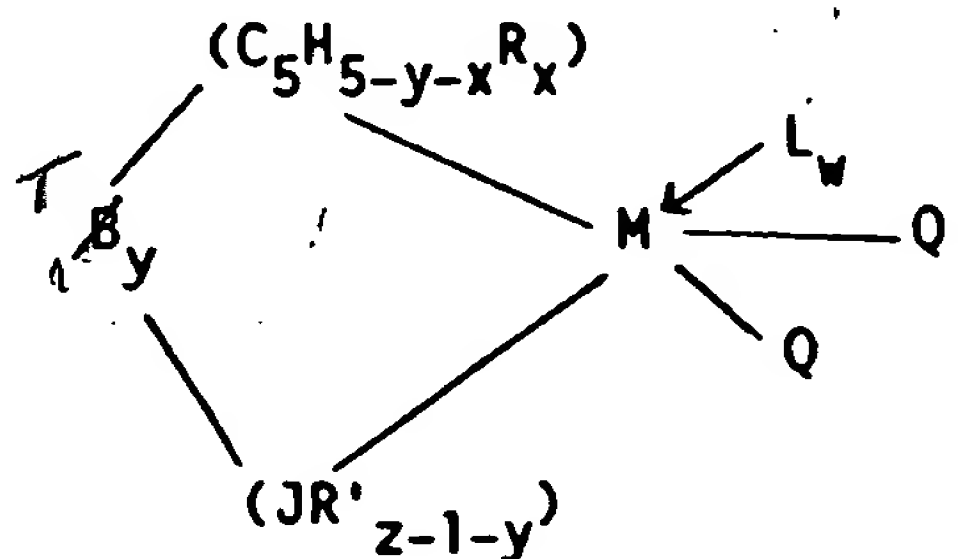
1 3. The compound of claim 6 wherein Q is a halogen or  
2 hydrocarbyl radical.

1 4. The compound of claim 2 wherein the heteroatom ligand  
2 group J element is nitrogen.

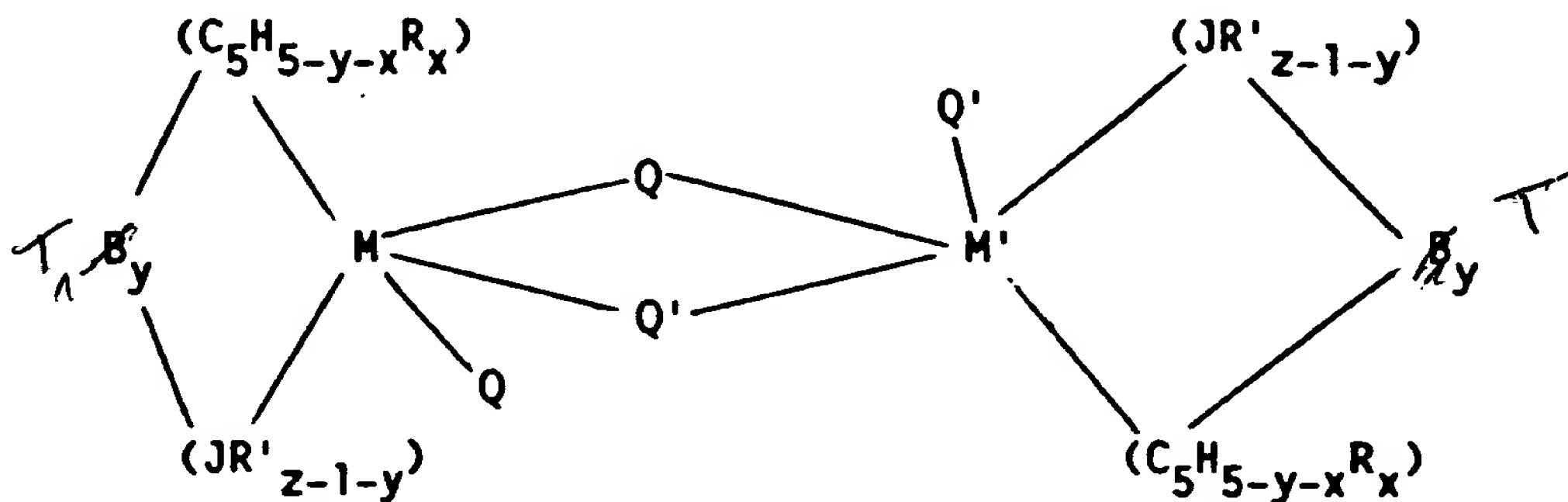
1 5. The compound of claim 1 wherein M is zirconium or  
2 hafnium.

1 6. The compound of claim 1 wherein Q is independently,  
2 halogen, hydride, or a substituted or unsubstituted C<sub>1</sub>-C<sub>20</sub>  
3 hydrocarbyl, alkoxide, aryloxy, amide arylamide, phosphide or  
4 arylphosphide, provided that where any Q is a hydrocarbyl such Q is  
5 different from (C<sub>5</sub>H<sub>4-x</sub>R<sub>x</sub>) or both together are an alkylidene  
6 or a cyclometallated hydrocarbyl.

- 1 A catalyst system comprising:  
2 (A) a Group IV B transition metal component of the  
3 formula:



or



- 4 wherein M is Zr, Hf or Ti;  
5  $(C_5H_{5-y-x}R_x)$  is a cyclopentadienyl ring which is  
6 substituted with from zero to five groups R, "x" is 1, 2, 3, 4 or 5  
7 denoting the degree of substitution, and each R is, independently, a  
8 radical selected from a group consisting of  $C_1-C_{20}$  hydrocarbyl  
9 radicals,  $C_1-C_{20}$  substituted hydrocarbyl radicals wherein one or  
10 more hydrogen atoms are replaced by a halogen atom,  $C_1-C_{20}$   
11 hydrocarbyl-substituted metalloid radicals wherein the metalloid is  
12 selected from the Group IV A of the Periodic Table of Elements and  
13 halogen radicals or  $(C_5H_{5-y-x}R_x)$  is a cyclopentadienyl ring in  
14 which two adjacent R-groups are joined forming  $C_4-C_{20}$  ring to  
15 give a saturated or unsaturated polycyclic cyclopentadienyl ligand;  
16  $(JR'_{z-1-y})$  is a heteroatom ligand in which J is an  
17 element with a coordination number of three from Group V A or an

40  
11 14  
L L  
P1  
3  
P1  
P1  
P1  
P1

18 element with a coordination number of two from Group VI A of the  
19 Periodic Table of Elements, each R' is, independently a radical  
20 selected from a group consisting of C<sub>1</sub>-C<sub>20</sub> hydrocarbyl radicals,  
21 substituted C<sub>1</sub>-C<sub>20</sub> hydrocarbyl radicals wherein one or more  
22 hydrogen atoms is replaced by a halogen atom, and "z" is the  
23 coordination number of the element J;  
24 each Q is, independently any univalent anionic ligand  
25 or two Q's are a divalent anionic chelating agent;  
26 "y" is 0 or 1 when w is greater than 0; y is 1 when w  
27 is 0, when "y" is 1, B is a covalent bridging group containing a  
28 Group IV A or V A element;  
29 L is a Lewis base where "w" denotes a number from 0 to  
30 3; and  
31 (B) an alumoxane.

NP  
NK

1 2. The catalyst system of claim 1 wherein the heteroatom  
2 ligand group J element is nitrogen, phosphorous, oxygen or sulfur.

1 3. The catalyst system of claim 1 wherein Q is a halogen  
2 or hydrocarbyl radical.

1 4. The catalyst system of claim 1 wherein the heteroatom  
2 ligand group J element is nitrogen.

1 5. The catalyst system of claim 1 wherein M is zirconium  
2 or hafnium.

1 6. The catalyst system of claim 1 wherein the mole ratio  
2 of Al:M is from 10:1 to about 20,000:1.

H 14  
H

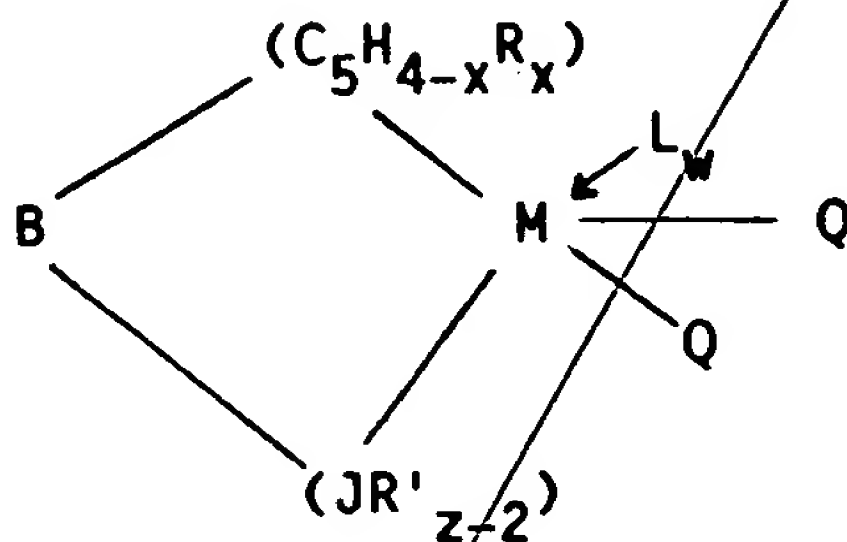
1 7. The catalyst system of claim 1 wherein Q is  
2 independently halogen, hydride, or a substituted or unsubstituted  
3 C<sub>1</sub>-C<sub>20</sub> hydrocarbyl, alkoxide, aryloxy, amide arylamide,  
4 phosphide or arylphosphide, provided that where any Q is a  
5 hydrocarbyl such Q is different from (C<sub>5</sub>H<sub>4-x</sub>R<sub>x</sub>) or both

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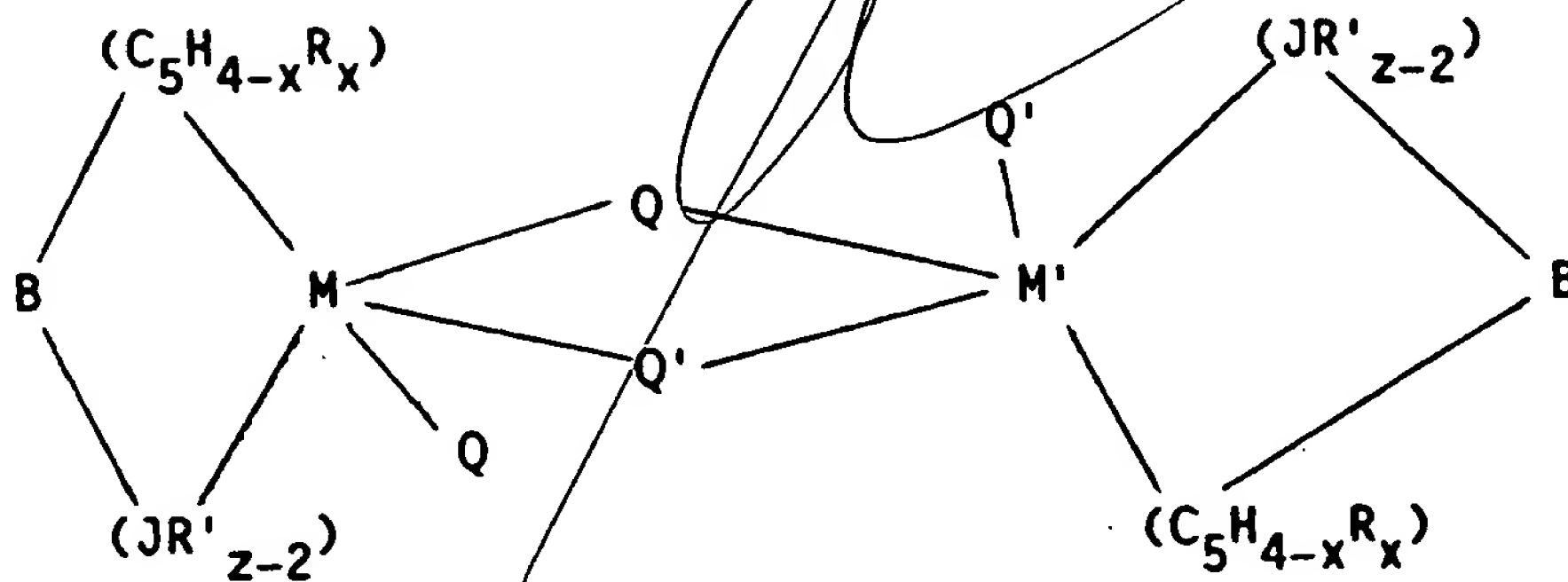
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6 together are an alkylidene or a cyclometallated hydrocarbyl.

1 14. A process producing a compound represented by the  
2 formula:



or



3 wherein M is Zr, Hf or Ti;

4  $(C_5H_{4-x}R_x)$  is a cyclopentadienyl ring which is  
5 substituted with from zero to four substituent groups R, "x" is 0, 1,  
6 2, 3, or 4 denoting the degree of substitution, and each substituent  
7 group R is, independently, a radical selected from a group consisting

claim 7

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8 of  $C_1-C_{20}$  hydrocarbyl radicals, substituted  $C_1-C_{20}$   
9 hydrocarbyl radicals wherein one or more hydrogen atoms is replaced  
10 by a halogen atom,  $C_1-C_{20}$  hydrocarbyl-substituted metalloid  
11 radicals wherein the metalloid is selected from the Group IV A of the  
12 Periodic Table of Elements, and halogen radicals or  $(C_5H_{4-x}R_x)$   
13 is a cyclopentadienyl ring in which two adjacent R-groups are joined  
14 forming  $C_4-C_{20}$  ring to give a saturated or unsaturated polycyclic  
15 cyclopentadienyl ligand;

16  $(JR'_{z-2})$  is a heteroatom ligand in which J is an  
17 element with a coordination number of three from Group V A or an  
18 element with a coordination number of two from Group VI A of the  
19 Periodic Table of Elements, and each R' is, independently a radical  
20 selected from a group consisting of  $C_1-C_{20}$  hydrocarbyl radicals,  
21 substituted  $C_1-C_{20}$  hydrocarbyl radicals wherein one or more  
22 hydrogen atoms is replaced by a halogen atom, and "z" is the  
23 coordination number of the element J;

24 each Q is, independently any univalent anionic ligand  
25 or two Q's are a divalent anionic chelating agent;

26 B is a covalent bridging group containing a Group IV A  
27 or V A element; and

28 L is a Lewis base where "w" denotes a number from 0 to  
29 3;

30 consisting of reacting of  $d^0$  Group IV B transition  
31 metal halide with a salt containing an anion of the formula  
32  $[(C_5H_{4-x}R_x)-B-(JR'_{z-2})]^{2-}$  and either two cations from the  
33 Group I A of the Periodic Table of Elements or one cation from the  
34 Group II A of the Periodic Table of Elements.

1 15. The process of claim 14 wherein the cation is lithium.

1 16. The process of claim 14 wherein the Group IV B metal  
2 halide is zirconium (IV) chloride or hafnium (IV) chloride.

1 17. The process of claim 14 wherein Q is independently  
2 halogen, hydride, or a substituted or unsubstituted  $C_1-C_{20}$

- 3 hydrocarbyl, alkoxide, aryloxi, amide, arylamide, phosphide or
- 4 arylphosphide, provided that where any Q is a hydrocarbyl such Q is
- 5 different from  $(C_5H_{4-x}R_x)$  or both Q together are an alkydene
- 6 or a cyclometallated hydrocarbyl.